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Indian Standard

INDUSTRIAL STEAM AND HOT WATER BOILER PLANTS — MAINTAINING OF LOG AND SUMMARY SHEETS — RECOMMENDATIONS

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Boilers Sectional Committee, HMD 01

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Boilers Sectional Committee had been approved by Heavy Mechanical Engineering Division Council.

This Indian Standard is based on BS 1374 : 1972 'Recommendations on the use of British Standard log sheets for steam and hot water boiler plants' issued by the British Standards Institution (BSI).

Indian Standard

INDUSTRIAL STEAM AND HOT WATER BOILER PLANTS — MAINTAINING OF LOG AND SUMMARY SHEETS — RECOMMENDATIONS

1 SCOPE

Provides guidance for maintaining log and summary sheets for industrial steam and hot water boiler.

2 INSTRUMENTATION

2.1 The following instruments and measuring equipment are recommended for carrying out the measurement and noting down the readings:

a) Means for ascertaining the quantity of water evaporated [either the water fed into the boiler(s) or the steam produced by the boiler(s) may be measured] and/or means of measuring the heat outputs;

b) Means for ascertaining the mass of fuel burned;

c) Draught gauges;

d) Temperature measuring instruments;

e) Flue gas analysers — indicators or recorders;

f) Steam pressure recorders;

g) Feed water make-up meters;

h) Chemical apparatus for controlling the condition of the boiler water; and

j) Means for ascertaining the calorific value of fuel.

3 USE OF LOG SHEETS

3.1 Readings

Provisions has only been made on the log sheets for the recording of the readings of instruments where a spot reading has any value as a record, thus giving the essential information with the minimum amount of labour. Certain of the points mentioned below are not applicable when liquid or gaseous fuel are being used.

3.2 Record for Boilers Operating

Record the number of hours of operating of each boiler. On a daily log sheet the nubers of the boilers operating shall be recorded on the first line and any alterations recorded at the appropriate time. This information is useful in systematizing maintenance and in controlling boiler water condition.

3.3 Record for Boilers on Banks

Record the number of boilers on bank, as well as those operating, to enable the amount of fuel used for banking to be kept under observation. The mass of the fuel used for banking shall be recorded regularly wherever possible, but frequently it is only possible to make occasional spot observations of the quantity. The space columns can be used appropriately for this purpose.

3.4 Record for Steam Pressure and/or Outgoing Water Temperature

3.4.1 *Steam Boilers*

Provision is made for recording steam pressure. When several boilers are steaming, this reading shall always be taken from same boiler, since there will probably be deferences in the readings on different gauges. Such spot readings have very limited value, and it is recommended that a recording pressure gauge should be installed in the main steam line. This furnishes a full record of the variations in pressures and direct attention to any need for investigating an abnormal fluctuation.

3.4.2 *Hot Water Boilers*

Provision is made for recording the outgoing flow temperature. When several boilers are operating, this reading shall always be taken at a point in the common main as near to the boilers as possible.

3.5 Record for Feed Water Temperature

3.5.1 Provision is made for recording feed water temperature at both the economiser and boiler inlets. Where each boiler has its own economiser, it will generally be sufficient to record the reading on one boiler every hour, dealing with each boiler in rotation. Where there is no economiser, the temperature of the water being

fed to the boiler should be entered in the appropriate column. Where cold water is used, there is no advantage in recording the temperature hourly, but with hot water this reading services to direct attention to any falling off in temperature and consequent loss in efficiency due to faults developing in the heat-recovery equipment, such as condensate or other return, which might otherwise be overlooked.

3.5.2 A record of the temperature of the water entering and leaving an economiser serves to direct attention to any falling off its efficiency.

3.6 Record for Flue Gas Temperature

3.6.1 Provision is made for recording the temperature at the inlet and outlet of the economiser and it is assumed that; where there is more than one economiser, a reading shall be taken on each in rotation. Knowledge of the temperature of the gas leaving the boiler or entering the economiser, when considered in conjunction with the boiler load, directs attention to any falling off in efficiency, as an increase in temperature for given load usually indicates either fouling of the boiler heating surface or by passing of gases.

3.6.2 A record of the temperature of the gases leaving the economiser, in addition to that at entry, discloses any falling off in economiser efficiency by a lowering of the difference between these two temperatures at a given load. This may result from either fouling of economiser heating surface or opening of gas by pass where this exists.

3.6.3 Where there is no economiser, the temperature of the gas leaving the boiler shall be recorded in appropriate column.

3.7 Record for Steam Temperature

3.7.1 Where super heaters are installed, the degree of super heater is not normally under the control of the operator. Observation of the temperature of the steam leaving the super heater will, however, direct attention to any falling off, which may be due to fouling of super heater heating surface, or to priming. As the load of the boiler increased, if there is no priming the temperature tends to rise; a marked decrease generally indicates priming.

3.7.2 Generally it is essential that the steam temperature should be recorded every hour on all boilers but it is recommended that this temperature shall be taken at least once a shift on each boiler, preferably always at the same load, to keep the point generally under observation. Irregularities may indicate the disability for closer investigation.

3.7.3 Where steam is not superheated, there is no point in recording its temperature on the log sheet.

3.8 Record for Evaporation or Heat Output

3.8.1 The principle object of ascertaining the evaporation or heat output obtained from the boiler plant is in conjunction with the fuel records, to keep under constant observation the fuel cost of generating steam or heating water. Evaporation may be ascertained by the use of water meter or integrating steam flow meter. When a water meter is used the quantity of water blown down shall be deducted. The heat output of hot water boilers can be ascertained by the use of integrating meter.

3.8.2 In order to obtain a clear picture showing fluctuations, which have an important influence on efficiency, it is necessary to employ a recording meter.

3.9 Record for Blow Down

The quantity of water blown down shall be recorded as a difference in level in the guage glass, from which the mass can be calculated. Importance of the item is to check that only the necessary quantity of water is blown down to maintain the boiler water in a satisfactory condition.

3.10 Record for Fuel Used

3.10.1 *Solid Fuel*

The method used for determining the mass of solid fuel fired to the boilers depends on the arrangements made for handing fuel at each works. If whole of the fuel supplied to the boilers can be weighed directly as it enters the works, the weigh bridge record may be accepted as the quantity used over an extended period, say, for a week or a month.

3.10.1.1 Where the fuel is used for purposes other than for firing the boilers to which these forms relate, other methods have to be used. If the coal is handled mechanically, it may be possible to use some form of coal meter. This may be a direct weighing machine or a volumetric measuring device. Such devices are often attached to automatic stokers, in which case reading shall be recorded regularly and converted to a mass of fuel as required, using an appropriate factor. It may be possible to use a bunker as the means of measurements. For example, if there are two bunkers, in that case one can be used exclusively by the boiler operators during a shift while other can be utilised for filling the fresh coal.

3.10.1.2 Where boilers are fired by hand the mass of solid fuel used can generally be obtained by weighing it in barrows over a weigh bridge as it is being wheeled into boiler house. If it is not possible to weigh each barrow load individually, a rectangular barrow can be used holding, when levelled off, a known volume of coal, a barrow load is weighed occasionally, say once a shift, as a check, and the reading is noted down on the log sheet.

3.10.1.3 Alternatively, in case of hand fired boilers, volumetric measurement on the floor of the boiler house can be adopted. Such measurement is provided by filling a rectangular gauge box having a capacity of 50 kg or more, open top and bottom, and levelling off the top surface. However, volumetric methods are not as accurate as direct weighing, but provide a useful check on fuel consumption in the absence of facilities for weighing. It is desirable that the mass of the contents shall be checked periodically, particularly when there is change of fuel. The quantity of fuel used, as given on the log sheet, shall be checked by estimation of the fuel in bunkers and store at the beginning and end of the week, taking into account the mass of the fuel delivered during that period.

3.10.1.4 It is sometimes convenient to record on the log sheet the quantity of fuel fed into the boiler furnace each hour, but hourly recorded consumption has no real significance because, owing to the inevitable variations in fire thickness, it is extremely difficult to measure the fuel burned with anything approaching accuracy over such a short period.

3.10.2 *Liquid Fuel*

Where oil meters are used, any fuel recirculated to a point upstream of a meter shall be taken into account in determining the quantity consumed. Oil flow and return temperatures shall be measured to obtain accurately the quantity of all consumed.

3.10.3 *Gaseous Fuel*

For gas fired boilers, the supply temperature of the gas shall be recorded.

3.11 Record for Cleaning of Fires

3.11.1 Where fires are cleaned by hand, it is useful to have a record of the times of cleaning. This will serve as a check on the carrying out of this operation at the most suitable times to meet load requirements which may be useful in explaining variations in readings, such as stream pressure, flue gas steam temperatures, and flue gas analysis.

3.11.2 When it is not practicable to record the mass of ashes each time the fire is cleaned, provision shall be made for recording the total daily or at each shift.

3.12 Record for Draught Measurement

The draught in the plant shall be measured by suitable draught gauges and record be maitained. Only under exceptional conditions the plant can be operated efficiently without their aids.

3.13 Record for Flue Gas Analysis

For efficient operation it is essential to have suitable flue gas analysis, as only under exceptional conditions the plant can be operated efficiently without their aids. The flue gas analysis, shall have recording instruments, as the picture furnished by a complete record is very valuable.

3.14 Records for Additional Readings

3.14.1 *Records*

Records for special items, which are not of general application, shall be maintained at frequent intervals. Provisions have been made for this in the log sheets by providing the blank columns in the log sheets.

3.14.2 *Remarks*

Comments on the quality of the fuel, any difficulty in firing it or in cleaning the fires, and any unusual occurrence during the shift or any items of maintenance which require attention shall be maintained by the boiler operator in the 'Remarks' space provided in the log sheet. Maintenance of the above records are very important and the log sheet is the real record of the boiler house for the day.

3.15 Record of Outside Air Temperature

Where the whole or part of the steam or hot water output is utilized for space heating purposes, it is often very useful in considering plant performance to have a record of the outside air temperature. The record of the outside air temperature shall be maintained at the commencement of each shift.

3.16 Record of Fuel

The record of the kind of fuel used in each day, particularly where there is changes shall be maintained. The description shall be as complete as possible to assist in the comparision of day to day performance.

3.17 Record of Evaporation or Heat Output per Unit of Fuel

The evaporation or heat output per unit of fuel, considered in conjunction with the type fuel used and, in the case of steam boilers, the feed water temperature, shall generally serve as a useful indication of the variation in efficiency from day to day or shift to shift.

3.18 Record of Ashes

Mostly in the small boiler plants, it is not practicable to sample and analyse the fuel and the ash. Therefore, recording the mass of the ash and clinker, attention is directed to important changes in the amount of ashes as the percentage of fuel, which on investigation may be explained by a change in the quantity of the fuel or in the variation in the operating efficiency as indicated by an abnormal amount of combustible material in the residue.

3.19 Record for Make-up Feed Water

Record shall be maintained daily the quantity of make-up water used. Where the make-up, expressed as a percentage of evaporation, increases, this may be due to wastage of hot condensate not otherwise detected or to additional blow down. In the case of hot water boilers, an increase of the make-up water may be due to blow down or may indicate leakage in the system. This information is also necessary for the control of feed water treatment. When a boiler is refilled after emptying this fact shall be recorded under 'General comments' and the quantity, if it has passed through the meter, deducted from the feed water total.

NOTE — If the water meter records in cubic meters, conversion to kilograms by multiplying by 1 000 is generally sufficiently accurate. If the record is in litres, no multiplication is necessary.

3.20 Record for General Comments

Provisions have been made in the log sheet for recording 'General comments' where observations of the engineer or other official responsible for the performance of the boiler plant shall be maintained.

3.21 Maintenance of Daily Log Sheets and Weekly Summary Sheets

3.21.1 Typical log sheets and weekly summary sheets for maintaining the data have been given in the Annexures as mentioned below:

a) Annex A Boilerhouse daily log sheet for steam boilers (Form 1);

b) Annex B Boilerhouse daily log sheets for hot water boilers (Form 2);

c) Annex C Boilerhouse weekly summary sheets for steam boilers (Form 3); and

d) Annex D Boilerhouse weekly summary sheets for hot water boilers (Form 4).

3.21.2 Forms 3 and 4 are the sheets upon which the essential daily information is summarized. In addition, provision is made for recording the cost of fuel for kilogram of water evaporated or per kcal of heat out put.

ANNEX A

[*Clause* 3.21.1 (a)]

BOILERHOUSE DAILY LOG SHEET : STEAM BOILERS

Date..... .....

Plant... ....

STEAM					WATER					FLUE GASES				DRAUGHT			FUEL						AIR			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Time	Boiler No.	Press. kgf/cm² (g)	Temp. °C		Temp. econ. inlet °C	Temp. boiler inlet °C	Meter reading feed water litres	Meter reading make-up water litres		Temp. boiler outlet °C	Temp. econ. outlet °C	CO_2 or O_2 %		Press. in comb. chamber mWC	Press. at boiler outlet mWC		Flow meter kg. or m³ or litres	Return meter kg. or m³ or litres	Flow temp. °C	Return temp. °C	Ashes kg		Outside temp. °C			Remarks
										Large size sheet — 30 lines Small size sheet — 22 lines																
Total																										
No. of readings																										
Average																										

SUMMARY FOR DAY

Fuel type and grade.....Density (20/20)..... .....
or Calorific value kcal/kg or kl/m³

Fuel used (metered).....

Fuel used (corrected to 20°C).....

Fuel used.....kg

Evaporation of steam ; total.....kg

Evaporation of steam per kg of fuel.....kg

Ashes : total..... kg =.....% of fuel

Load of flow.....

Return oil flow (for oil fired furnace)

Operators on duty	First shift	Second shift	Third shift

Feed water. Meter reading (beginning of day).....kg

Meter reading (end of day).....kg

Difference.....kg

Feed water pressure

Feed water *p*H

Make-up water.....kg =.....% of evaporation

Blow down (total) time.....Quantity.....

.....

GENERAL COMMENTS.....

.....

.....

ANNEX B

[*Clause* 3.21.1 (b)]

BOILERHOUSE DAILY LOG SHEET : HOT WATER BOILERS

Date..... Plant.....

WATER								FLUE GASES				DRAUGHT			FUEL						AIR			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Time	Boiler No.	Working Press	Temp. boiler outlet	Temp. boiler inlet	Temp. econ. inlet	Meter reading		Temp. boiler outlet	Temp. econ. outlet	CO_2 or O_2		Press. in comp. chamber	Press. at boiler outlet		Flow meter	Return meter	Flow temp.	Return temp.	Ashes		Outside temp.			Remarks
		kgf/cm² (g)	°C	°C	°C	kJ or litres		°C	°C	%		mWC	mWC		kg. or m³ or litres	kg. or m³ or litres	°C	°C	kg		°C			
								Large size sheet — 30 lines Small size sheet — 22 lines																
Total																								
No. of readings																								
Average																								

SUMMARY FOR DAY

Fuel grade.....Density (20/20).....

or Calorific value.....kcal/kg or kJ/m³

Fuel used (metered).....

Fuel used (corrected to 20°C).....

Fuel used.....kg

Ashes : total.....kg =.....% of fuel

Total water circulated.....litres

Average temperatue difference.....°C

Total heat output.....kcal

Total heat per kg of fuel.....kcal

Make-up water.....litres =.....% of total

Operators on duty :	1st shift	2nd shift	3rd shift

GENERAL COMMENTS.....

.....

.....

ANNEX C

[*Clause* 3.21.1 (c)]

BOILERHOUSE WEEKLY SUMMARRY SHEET : STEAM BOILERS

Week commencing.....

Plant.....

Date	Fuel consumed kg	Ashes kg or %	Water evaporated kg	Evaporation per kg or m³ of fuel kg	Make-up water % of total	Hours steaming							Remarks
Total													
No. of reading													
Average													

Total amount of fuel used.....kg at Rs.....per kg

.....litres (corrected to 20°C) at Rs.....per litre (or cubic metre, $=10^3$ litres)

Weekly total fuel costs Rs..... Weekly total chemical costs Rs.....

Cost of fuel for evaporating 1 000 kg of water.....

Remarks on weekly records.....

.....

ANNEX D

[*Clause* 3.21.1 (a)]

BOILERHOUSE WEEKLY SUMMARY SHEET : WATER BOILERS

Week commencing.....

Plant.....

Date	Fuel consumed kg	Ashes kg or %	Total water circulated kg	Average temperature difference °C	Total heat output kcal	Heat output per kg or m³ of fuel kcal	Make-up water % of total	Hours operating							Remarks
Total															
No. of readings															
Average															

Total amount of fuel used.....kg at Rs.....per kg

.....litres (corrected to 20°C) at Rs.....per litre (or cubic metre = 10^3 litres)

Weekly total fuel costs Rs.....

Weekly total chemical costs Rs.....

Cost of fuel per kcal.....

Remarks on weekly records.....

.....

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Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 11002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43, 53 16 40 53 23 84
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
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